Contract Number: W9132T-04-C-0018

Offeror: IdaTech, LLC

IdaTech 2003 PEM Demonstration Program
In Omaha, Nebraska with Offutt AFB/Omaha Public Power District

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Locations

1. Offutt Air Force Base, Building 304, Omaha, Nebraska
2. Offutt Air Force Base, Elkhorn 200, Omaha, Nebraska

July 7, 2004

Executive Summary

The offeror and manufacturer, IdaTech, will demonstrate two systems at the Offutt AFB in Omaha, NE with Subcontractor Omaha Public Power District (OPPD). One Offutt AFB system uses propane fuel, operates off-grid and is located outdoors. The other Offutt system uses natural gas fuel, operates off-grid and is located indoors. Neither system operates in CHP mode.

System	Location	Fuel	Mode	CHP	Location
#1	Omaha, NE	Propane	off-grid	no	outdoor
#2	Omaha, NE	natural gas	off-grid	no	indoor

The energy generated from the demonstration is estimated to be approximately 31,503 kWh of electricity assuming that the fuel cell systems operate at an average output of 2.0 kW for 90% of a full year per system.

The point of contact at Offutt AFB will be, Mark Tungland, Energy Manager, Phone 402-294-5379, 55th CES/CECEE, Offutt AFB, NE. 68113, mark.tungland@offutt.af.mil.

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

IdaTech 2003 PEM Demonstration Program in Omaha, Nebraska with Offutt AFB/Omaha Public Power District.

2.0 Name, Address and Related Company Information

Name: IdaTech, LLC (IdaTech)
Address: 63065 N.E. 18th St., Bend, OR 97701
Phone: 541-383-3390
Fax: 541-383-3439
DUNS Number: 95-789-2193 CAGE Code: 1M0T9
TIN: 93-1202376

Located in Bend, Oregon, IdaTech is a world-class energy technology company focused on the development and commercialization of fuel processor technology and integrated Proton Exchange Membrane (PEM) fuel cell solutions. Founded in 1996, IdaTech has developed some of the most compact and efficient fuel processors and fuel cell systems operating on a variety of common fuels, including natural gas, propane, methanol, and low-sulfur liquid hydrocarbons. Additionally, IdaTech continues integrating its fuel processor technology with the best available fuel cell power modules to develop power systems from 250 watts to 50 kilowatts for a wide range of portable and stationary applications. These systems are being demonstrated, evaluated, and field-tested in various applications with business partners in North America, Europe, and Japan. IdaTech currently employs approximately 90 people.

3.0 Production Capability of the Manufacturer

As described in Section 2.0 above, IdaTech is a world-class developer and manufacturer of fuel cell systems and fuel cell components including fuel processors and fuel cell stacks and is fully capable of supplying the required components for the proposed systems. IdaTech manufactured approximately 25 fully integrated fuel cell systems in 2003 and 30 in 2004. IdaTech's philosophy towards manufacturing volume and demonstrations is orderly development. In practice, this means IdaTech manufactures enough systems to statistically validate technology advances and then places a limited number of those systems in the field to further validate the technology. This discipline ensures that IdaTech engineers are able to advance development goals rather than continuously support prototype demonstrations. IdaTech has selected this CERL opportunity due to its outstanding opportunity to display high performance in a well-publicized forum to a key target market.

In support of the field demonstration IdaTech will provide support through 40 hours of on-site field installation services and 30 hours of training services that will be provided with the delivery of the fuel cell system. Site preparation including an appropriate pad,

plumbing potable water, electrical interconnection with load including transfer switch if needed and any required security and landscaping are the responsibility of the host site and partner utility. Site remediation is also outside the scope of the fuel cell manufacture and will be provided by the host site and utility partner.

IdaTech contact information is detailed in Section 2.0 above.

4.0 Principal Investigator(s)

William A. Pledger
Senior Vice President & Chief Engineer
IdaTech, LLC
Phone: 541-322-1025
Fax: 541-383-3439
E-Mail: bpledger@idatech.com

Education
1982: B.S. in Chemical Engineering, Oregon State University, Corvallis, Oregon
Professional Accreditation
1997: Professional Engineer in State of Oregon
Professional Highlights

1996-Present: Senior Vice President, Chief Engineer, IdaTech, LLC. Directs design, development and testing of fuel cell systems and major subsystems. Areas of expertise include metallic membranes, membrane reactors, membrane module design and construction, chemical process equipment and process modeling.

1994-1996: Chief Engineer, Micromonitors, Inc., Bend, Oregon. Responsible for field-testing and evaluation of microelectronic, electrical transformer fault gas analyzers.

1992-1994: Senior Engineer, Bend Research, Inc., Bend, Oregon. Responsible for design and construction of membrane-based systems and pilot plants. Areas of expertise include process modeling and electronic system design and construction.

1985-1992: Research Engineer, Bend Research.

Bill Pledger can be reached through the contact information listed in section 2.0 above.

5.0 Authorized Negotiator(s)

Name: Hal Koyama
Title: Vice President of sales and Marketing
Company: IdaTech, LLC
Phone: 541-322-1000
Fax: 541-383-3439
Email: hkoyama@idatech.com

6.0 Past Relevant Performance Information

IdaTech has been successful developing systems and solutions that specifically address a customer's or development partner's business problem. The following is a list of recent examples:

1. Scaleable power solution for The U.S. Army Communications – Electronics Command (CECOM). CECOM contracted with IdaTech to develop a 2 kW fuel cell system to power an array of communications and other electronic equipment on a High Mobility Multipurpose Wheeled Vehicle (HMMWV - pronounced Hum-Vee).
   Customer: US Army – CECOM
   Contact: Nicholas Sifer – FC Program Manager
   Phone and/or e-mail: 703-704-0272 / Nicholas_Sifer@beml01.belvoir.army.mil
   Contract #: DAAB0798DH502/0039
   Dollar Value: ~US$ 226,000

2. Hybrid power solution combining fuel cells with photovoltaics – IdaTech and Electricite de France (EDF) jointly integrated a fuel cell system with photovoltaic (PV) technology in a hybrid power system for remote locations.
   Customer: Electricite de France
   Contact: Thierry Brincourt
   Phone and/or e-mail: 33 1 60 73 71 01 / thierry.brincourt@edf.fr
   Contract #: F 57992/0
   Dollar Value: ~US$ 455,000

3. Propane fueled fuel cell system for telecommunication applications – Working under two funding grants from the Propane Education and Research Council (PERC), IdaTech proved its' capabilities related to fuel processing and system integration for propane fueled fuel cell systems.
   Customer: Propane Education and Research Council (PERC)
   Contact: Larry Osgood
   Phone and/or e-mail: 719-487-0080 / LDOgood1@aol.com
   Contract #: Docket No's 10229 & 10857
   Dollar Value: ~US$ 742,000

4. Natural gas fuel cell system for German Utility – Over a three month period, IdaTech worked closely with a German Utility for the design and development of a fully integrated natural gas fuel cell system for a multi-family building. IdaTech leveraged its modular design philosophy and took existing building blocks (fuel cell module, fuel processor module, power electronics, etc.) to have a system ready for factory acceptance testing within 60 days from time of contract.
   Customer: German Utility
   Contact: N/A (due to NDA)
   Phone and/or e-mail: N/A (Due to NDA)
   Contract #: 6560
   Dollar Value: ~US$ 203,000

7.0 Host Facility Information

Offutt AFB is home to the Fifty-Fifth Wing of the US Air Force. The 55th Wing is the largest wing in Air Combat Command and the second largest in the Air Force. The Fightin' Fifty-Fifth has made significant contributions to the defense of our nation for more than 50 years. Having won honor and distinction for its combat record during World War II with two Distinguished Unit Citations, the wing has since compiled an admirable record of achievements. The history of the Fightin' Fifty-Fifth began in January 1941, when the 55th Pursuit Group was activated at Hamilton Field, California. Assigned the mission of escorting 8th Air Force bombers on daylight bombing raids over Europe, the group completed its combat tour of duty with a distinguished record in seven campaigns. The 55th SRW moved to Offutt AFB, Nebraska, in August 1966. That same year the 55th's 38th Strategic Reconnaissance Squadron assumed responsibility for SAC's airborne command and control system. The 55th Strategic Reconnaissance Wing became the 55th Wing on September 1, 1991, to reflect the wing's performance of a diversity of missions. When SAC disestablished and Air Combat Command (ACC) established, the wing transferred to ACC.

Offutt AFB will be acting as a Project Partner and Site Owner to IdaTech. As the Site Owner, Offutt AFB will be responsible for identifying the site and gaining necessary approvals to site the fuel cell systems with the command of the base. Additionally, Offutt AFB personnel will be involved in operational training and participate in the installation and maintenance activities as required. Mark Tungland is authorized to act on behalf of Offutt AFB during the project development, site selection process, contract negotiations, and installation/operation of the fuel cell system. Mr. Tungland is the Energy Manager for Offutt. Contact Information is: phone 402-294-5379, 55th CES/CECEE, Offutt AFB, NE. 68113, mark.tungland@offutt.af.mil.

OPPD will be acting as a Project Partner and Sub-Contractor to IdaTech and is also the local electric utility. Propane will be supplied to the project by Ferrell Gas (402-895-2344). As the Sub-Contractor, OPPD will be responsible for the on-site project management, installation, start-up, and the on-going operational maintenance, support, and troubleshooting. Terry Johnson is authorized to act on behalf of OPPD during the proposal development, site selection process, contract negotiations, and installation/operation of the fuel cell system. Mr. Johnson is a Project Manager for OPPD. Contact Information: 402.636.3321 or via email at tdjohnson@oppd.com.

Figure 1. Front Gate at Offutt AFB

Offutt Air Force Base (Offutt AFB) and the Omaha Public Power District (OPPD) have established a strong relationship over the past 55 years. In addition to delivering WAPA and OPPD energy to the base, OPPD has worked closely with Offutt's 55th Civil Engineering Squadron to improve energy efficiency and technology through performance contracting. This has come in the form of nine demand side management projects (Task Orders) valued at nearly $18 million. These projects will enable Offutt to meet the presidential directive (Executive Order 12902) which requires a 30% energy reduction by the year 2005.

8.0 Fuel Cell Installation

One fuel cell system was placed at each of the two Offutt AFB sites described below. The PEM fuel cell systems were manufactured by the offeror, IdaTech. There were no special permitting issues required at either of the two Offutt AFB sites. The installation of the two systems took place over the period from November 15, 2004 to November 24, 2004.

Building 304 is located on the NE corner of the historic Martin Bomber Plant at Offutt AFB. This building contains a major portion of the electrical distribution switchgear that serves approximately 35% of the base electrical loads. Building 304 also houses the mechanical equipment that serves the HVAC needs of the plant and numerous surrounding support buildings. Building 304 is an ideal location for the fuel cell because of the numerous electrical distribution systems in-place and the 24/7 operating schedules of the electrical distribution, HVAC, and lighting systems.

Building 200 is Offutt AFB's remote UHF/VHF communications and relay facility located approximately 30 miles NW of Offutt AFB near Elk Horn, NE. This communication

facility serves numerous military, space, and civilian communication needs in the region. The facility has a peak electrical demand of less than 150 kW and has minimum operation personnel assign to it.

Figure 3. Actual locations of the fuel cell system inside Offutt AFB Building 304 (left) and outside Offutt AFB Elkhorn Building 200 (right).

Figure 4. Installed natural gas system inside Offutt AFB Building 304.

The system sited at Offutt Air Force Base, Building 304, is a natural gas fuel cell system that will be running inside, off grid, and will be continuous powering a 2 kW load that includes a UPS system battery charger and security lighting.

The fuel cell system contains five process flow connections. They are: a 6" galvanized duct for the system exhaust, a ½" NPTM fuel inlet, and a 3/8" tube "push-connect" for the de-ionized water inlet. There are also some electrical connections for power and remote monitoring.

The ancillary equipment in this system includes a DC/AC inverter designed to take the DC voltage from the fuel cell and change it to 120/240 VAC output, absorbed glass mat lead acid batteries in a 120 V/26 amp-hour bank, fuel clean up module for sulfur removal, a water purification system that has been designed with knowledge of local water quality, and a radiator system for heat dissipation.

The operating procedure for the system is to provide power for a battery charger and some security lighting that amounts to 1.5 to 2 kW_e. This will serve as the system's base load. The fuel consumption at base load conditions is approximately 13 slm of natural gas (@25°C) and 28 ml/min of water. The system ramps up as necessary to match an increase in the load. The fuel consumption at maximum output is approximately 28 slm of natural gas (@25°C) and 62 ml/min of water. The system is designed for unmanned operation unless the system calls for outside intervention. The run data from the system is retrieved by IdaTech in a process described below in Section 11.0.

Combustion exhaust and other gases are exhausted from the fuel cell system through an exhaust duct located at the back of the system enclosure. These gases must be vented to the outdoors through an exhaust ducting system. The exhaust ducting system includes a fan that must be installed in the exhaust duct.

Figure 5. Installed propane fuel cell system outside Offutt AFB Elkhorn Building 200.

The system sited at Offutt Air Force Base at Elkhorn Building 200 is a propane PEM fuel cell system that is running outside, off grid and continuously powers 2 kW AC of security lighting.

The PEM fuel cell system contains five process flow connections. They are: a 6" galvanized duct for the system exhaust, a ½" NPTM fuel inlet, and a 3/8" tube "push-connect" for the de-ionized water inlet. There are also some electrical connections for power and remote monitoring.

The ancillary equipment in this system includes a DC/AC inverter designed to take the DC voltage from the fuel cell and change it to 120/240 VAC output, absorbed glass mat lead acid batteries in a 120 V/26 amp-hour bank, fuel clean up module for sulfur removal, a water purification system that has been designed with knowledge of local water quality, a rugged outdoor enclosure to withstand the elements, a heater designed to keep the system from freezing, and a radiator system for heat dissipation.

The operating procedure for the system is to provide power for some security lighting that should amount to 1.5 to 2 kW_e. This will serve as the system's base load. The fuel consumption at base load conditions is approximately 6 slm of propane (@25°C) and 40 ml/min of water. The system ramps up as necessary to match an increase in the load. The fuel consumption at maximum output is approximately 12 slm of propane (@25°C) and 80 ml/min of water. The system is designed for unmanned operation unless the system calls for outside intervention. The run data from the system is retrieved by IdaTech.

Combustion exhaust and other gases are exhausted from the fuel cell system through an exhaust duct located at the back of the system enclosure. These gases must be vented to the outdoors through an exhaust ducting system. The exhaust ducting system includes a fan that must be installed in the exhaust duct.

All the site work was completed in advance of the installations. For preliminary site work as well as onsite system support, the services of Omaha Public Power District (OPPD) were retained. With regard to preliminary site work, OPPD was responsible for obtaining site permits, authorizations, preparing site for installation, procuring and installing LPG tank and lines, and assisting with installation including hook-ups for LPG, natural gas, water, electrical connections to power/utility panels, etc. Two IdaTech field service engineers were onsite performing the actual installation. During the installation period OPPD employees received onsite training so that they could perform routine maintenance on the fuel cell system.

One major challenge encountered shortly after installation was freezing of the outdoor system (Building 200) due to cold weather. This possibility was anticipated by IdaTech and as a result, propane space heaters were installed in the system. Unfortunately, the manufacturer of the space heaters issued a safety recall and the heaters had to be turned off. The fuel cell system shut down during this period and as a result, subsystems that contained water froze and were damaged. The components that were obviously damaged were replaced, but identifying all the damaged components required weeks of trouble shooting. During this period, the system availability was well below the required 90%. To get back on track and to eliminate the issues with freeze-damaged components, IdaTech replaced entire subsystems. The outdoor system official start

date is June 1, 2005 and the monthly data reporting will commence from that date forward.

A second major challenge that was encountered at the site was water damage to the indoor system. The system was installed in a location where there was a large water tank on the roof above the area where the system was installed. This water tank was a component for the customer's plant (Offutt AFB) and was not part of the installed fuel cell system. Water leakage from the tank formed large ice blocks during cold weather. When the ice blocks broke away, the roof above the system was damaged which allowed water to drain on to the IdaTech fuel cell system. On February 13, 2005, the system faulted and safely shut down. IdaTech attempted to restart the system and was having difficulty, so the customer's representative on site was contacted. The customer reported water running onto the system and disconnected it. The system had run ~1930 hours at an availability of 89%. The system was removed from service and shipped back to IdaTech for a damage assessment.

9.0 Electrical System

The fuel cell systems are being operated at approximately 2.0 kW AC electrical output and are used to power security lighting and a UPS battery charger. All systems are operated exclusively in grid-independent mode and will provide only AC output.

Each system is interconnected to the host site using a sub-panel and automatic transfer switch (ATS). The sub-panels are used to connect specific circuits that are powered by the fuel cell system. The ATS switches the sub-panel circuits back to grid power if the fuel cell system goes off-line for any reason.

One challenge that was encountered with the electrical system was with the grid-independent inverter. The manufacturer (Magnatek) was behind schedule in completing the development of the inverter, and when it was initially installed there were a number of issues with the controls and hardware of the inverter. While the controls optimization still needs to be completed, hardware solutions were implemented to prevent overcharging of the batteries.

10.0 Thermal Recovery System

Not Applicable.

11.0 Data Acquisition System

The data acquisition system is a National Instruments Field point measurement and control system. The data is recorded as a text file and is downloaded by IdaTech. The major parameters being monitored by the system are various reactor and fuel cell temperatures and pressures that are pertinent to control and safety. The fuel and water flow rates are monitored as well as the power output of the system. If any one of these parameters, or others that are monitored by the system, displays an out of range value it will cause a system fault.

All faults cause the fuel cell system to shut down. Upon sensing a fault condition, the fault indicator will illuminate, and the fuel cell system will automatically transition to the shutdown state and then to standby after the shutdown process has completed. The shutdown process requires approximately 5 minutes. During the shutdown process, the fault indicator will remain illuminated.

After reaching the standby state, the fault indicator will remain illuminated. All faults must be acknowledged and cleared by the user before the fuel cell system can be restarted. From the standby state, the fuel cell system may be restarted, or disconnected from the electric power source by opening the all-pole switch or disconnecting the plug and socket.

Due to security issues, IdaTech was not able to connect to a high speed data line at either of the sites. Typically, IdaTech has required a high speed data connection in order to monitor and remotely control the system. For these installations, it was decided to use satellite communications in order to access system data. Reliable communication with the system was the number one problem encountered during the initial months of operation. There were weather-related issues as well as hardware issues. Frequently, IdaTech was unable to remotely connect to the system to perform trouble-shooting or monitor system operation. Snow buildup on the satellite dishes prevented communication and required site visits to remove the snow. Hardware issues centered around keeping the satellite modem in an awake mode. After several months of working with the satellite provider, IdaTech believes that the hardware issues have been addressed.

12.0 Fuel Supply System

A 1,000 gallon propane tank supplies fuel to the outdoor fuel cell system (0083C). The propane specifications are:

- Contains less than 20% butane and heavier components in the gas phase (@ 32°F).
- Sulfur content averages ≤25 ppm on a yearly basis.
- Supply pressure is 7” to 30” water column.
- Nominal flow rate is 12 slm at full output.

The indoor natural gas system (0083B) is supplied natural gas at line pressure. The natural gas specifications are:

- Greater than 90% methane.
- Sulfur content averages ≤6 ppm on a yearly basis.
- Supply pressure is 7” to 30” water column.
- Nominal flow rate is 28 slm at full output.

13.0 Installation Costs

The tables below compare the estimated installation cost with the actual costs incurred for the indoor and outdoor installations:

Offutt Outdoor Installation Cost

	Budgeted Cost	Contractor Cost (as Billed)
OPPD Mechanical	$550	-
OPPD Electrical	$1,040	-
OPPD General	$495	-
Crane/Forklift	$250	-
Communications	$500	$871
Prpoane Installation	$400	-
Other Electrical	$4,424	-
Other Mechanical	$636	$143
OPPD Subcontractor	$0	$12,283
Sun/Snow Shelter	$0	$1,500
IdaTech Technician	$1,920	$5,120
IdaTech Travel	$2,690	$1,850
TOTAL	$12,905	$21,767

Offutt Indoor Installation Cost

	Budgeted Cost	Contractor Cost (as Billed)
OPPD Mechanical	$550	-
OPPD Electrical	$1,040	-
OPPD General	$495	-
Crane/Forklift	$250	-
Communications	$500	$871
Natural Gas Installation	$400	-
Other Electrical	$4,424	-
Other Mechanical	$636	$143
OPPD Subcontractor	$0	$7,641
IdaTech Technician	$1,920	$5,120
IdaTech Travel	$1,280	$1,850
TOTAL	$11,495	$15,625

14.0 Acceptance Test

Prior to shipping the system, a factory acceptance test was performed. The data can be seen in Appendix B. The procedure is shown in the table below

CERL Factory Acceptance Test Steps

#	Action	Description
1	Start system	System will execute standard start-up sequence beginning at standard room temperature (20-25°C). Record time to “Online” on the report sheet (# 1).
2	No Load	System will respond by charging batteries.
3	Apply medium load	System will respond by matching load and charging batteries.
4	Measure electrical output and efficiency	Record measurements.
5	Apply high load	System will respond by matching load and charging batteries.
6	Measure electrical output and efficiency	Record measurements.
7	Test Complete	System pass / fail.

Appendix A

Monthly Data Reports

Contract Number W9132T-04-C-0018

Monthly Data Report

(December 2004)

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Prepared By
William A. Pledger
IdaTech LLC

Offutt AFB, Omaha NE

1.0 Fuel Cell Site

The Fuel Cell is sited at Offutt Air Force Base's building 304, in Omaha Nebraska. The serial number for this indoor natural gas fuel cell system is S/N 0083B.

2.0 Summary/Milestones

System was installed and commissioned on November 20, 2004. While the system operated well, a lot of difficulties with reliable system communication were encountered. There where also issues with the process water flow meter drifting out of calibration that resulted in false steam to carbon faults in the fuel processor.

MONTH	#days	Tot Mth hrs	Start hrs	End hrs	Tot run hrs	Month Avail	Running Avail
Nov - Dec-04	41	991	277	1002	911	92%	92%

3.0 Scheduled Outages

None

4.0 Unscheduled Outages

System Number: 083B

Outage Date(s)	Duration	Description
12-1-2004	Unknown	Multiple Steam to Carbon Low Faults - System Restarted
12-2-2004	Unknown	Steam to Carbon Faults Feed Pressure Transducer Fault due to low batteries. Batteries recharged onsite and system restarted.
12-3-2004	Unknown	Multiple Steam to Carbon low faults. Water flow pump and meter were calibrated and system was restarted. Multiple Burner Control Faults – System restarted. H2 Quality Faults – System restarted.
12-8-2004	Unknown	Steam to Carbon Low – System Restarted.
12-9-2004	Unknown	Steam to Carbon Low – System Restarted.
12-10-2004	Unknown	Steam to Carbon Low – Replaced water flow meter with new calibrated meter. System restarted.
12-31-04	Unknown	Bad cable connection and modem replaced.

5.0 Component Replacement

Replaced process water flow meter on 12-10-2004 (approximately 426 hours on this component prior to failure). The process water flow meter was replaced due to repeated “low flow rate” faults during startup.

Faulty communications cable on system replaced 12-31-2004 (approximately 911 hours on this component prior to failure). The cable was inspected due to communication faults, found to have marginal crimps on one of the pins. Replaced with a spare 10-foot cable.

6.0 Other Comments

Satellite communication issues prevented determining exact duration of outages.

Contract Number: W9132T-04-C-0018

Monthly Data Report

(January 2005)

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Prepared By
William A. Pledger
IdaTech LLC

Offutt AFB, Omaha NE

1.0 Fuel Cell Site

The Fuel Cell is sited at Offutt Air Force Base's building 304, in Omaha, Nebraska. The serial number for this indoor natural gas fuel cell system is S/N 0083B.

2.0 Summary/Milestones

System reliability dropped this month to 80% primarily due to ongoing satellite communication issues –hardware, software and weather-related. Continued to work with the manufacturer and distributor to trouble shoot the problem.

MONTH	#days	Tot Mth hrs	Start hrs	End hrs	Tot run hrs	Month Avail	Running Avail
January-05	31	744	1002	1612	610	80%	87%

3.0 Scheduled Outages

01-21-2005 System was shut down to modify fuel cell module.

4.0 Unscheduled Outages

System Number: 083B

Outage Date(s)	Duration	Description
01-01-2005	113 hrs	Data file error. System shut down due to inability to retrieve data remotely from system controller. Communications was re-established and all data was retrieved.
1-05-2005	18 hrs	Burner control fault and modem communication issues. System restarted

5.0 Component Replacement

The 10-foot communication cable installed on December 31 (as a replacement for the original faulty cable) was replaced with a cable of the proper length (1.5 feet).

6.0 Other Comments

We worked extensively with satellite manufacturer to troubleshoot communications problems with system. Various outages were extended due to unavailability of satellite communications, or availability of personnel to go onsite due to adverse weather - snow.

Contract Number W9132T-04-C-0018

Monthly Data Report

(February 2005)

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Prepared By
William A. Pledger
IdaTech LLC

Offutt AFB, Omaha NE

1.0 Fuel Cell Site

The Fuel Cell is sited at Offutt Air Force Base's Elkhorn Facility, Omaha Nebraska. The serial number for this indoor natural gas fuel cell system is S/N 0083B.

2.0 Summary/Milestones

System had improved reliability this month until the system was flooded by a roof leak. The leak was discovered when support people went on site because the system was not able to be restarted. The system was shut down pending a structural safety review of the site. When the site is deemed safe for workers to enter the system will be sent back to IdaTech for a damage assessment.

MONTH	#days	Tot Mth hrs	Start hrs	End hrs	Tot run hrs	Month Avail	Running Avail
February-05	14	324	1612	1930	318	98%	89%

3.0 Scheduled Outages

None

4.0 Unscheduled Outages

System Number: 083B

Outage Date(s): February 13, 2005

Duration: 6 hrs

Description: Hydrogen quality fault, system restarted.

System Number: 083B

Outage Date(s): February 14, 2005

Duration: Unknown

Description: Fuel processor module fault – unable to restart system. Sent personnel onsite and discovered water draining onto system from roof leak.

7.0 Component Replacement

None

8.0 Other Comments

In follow on discussions with OPPD and Offutt AFB, it was determined that the best course of action would be to ship the system back to IdaTech so that a damage assessment could be performed. The system was shipped back to IdaTech and a damage assessment was completed.

Contract Number: W9132T-04-C-0018

Monthly Data Report

June 2005

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Prepared By
William A. Pledger
IdaTech, LLC

Offutt AB, Elkhorn NE

1.0 Fuel Cell Site

1. Offutt Air Force Base, Building 304, Omaha, Nebraska, System No. 0083B.
2. Offutt Air Force Base, Elkhorn 200, Omaha, Nebraska, System No. 0083C

2.0 Summary/Milestones

System availability for 0083C (outdoor, LPG system) for the month of June 2005 was 93.8%. System 0083B (indoor, natural gas system) was damaged by a leaking roof, removed from service, and shipped back to IdaTech. A preliminary damage assessment of the system 0083B has been performed.

3.0 Scheduled Outages

None

4.0 Unscheduled Outages

System Number: 083C
Outage Date(s): June 1, 2005
Duration: 15.5 hours

Description: Burner control fault for incomplete combustion. Restarted system.

System Number: 083C
Outage Date(s): June 2, 2005
Duration: 14 hours

Description: Burner control fault for incomplete combustion. Will need to update the burner control software when possible to allow more time for the igniter glow plug to heat up during startup. The software is scheduled to be upgraded during the next system shutdown.

System Number: 083C
Outage Date(s): June 28, 2005
Duration: 7 hours

Description: Multiple low cell voltages. Two cells are exhibiting lower than normal output voltages.

5.0 Component Replacement

None.

6.0 Other Comments

None

Appendix B

Acceptance Test Data

CERL FAT Test Summary (OFFUTT Propane system)

System Serial Number: 083C

		Measured							Calculated			
Time	FAT Test Step	Net AC	AC BoP	Battery (viewer)	Gross Stack (viewer)	DC BoP	Fuel-Flow (Viewer)	Thermal (viewer)	Thermal corrected	Est Net AC	Elec Eff.	CHP Eff.
		Watts	Watts	Watts	Watts	Watts	L/min	Watts	Watts	Watts		
11:15 AM	4	1678	350	0	2800	522	7	4000	3157.895	1678	17.2%	
12:56 PM	6	3528	404	-300	5500	590	11.7	9200	7263.158	3828	23.4%	
5:23 PM		3528	391	0	5300	575	11	10000	7894.737	3528	23.0%	

* Positive discharging

CH2 AC BoP
CH3 Gross Stack Power
CH4 DC BoP
CH5 Gross AC

Propane LHV 1397 Watts per liter per minute

Cp Cool (actual) 3.3 kJ / kg Water /glycol mix
Cp Cool (viewer) 4.18 kJ / kg Water

CERL FAT Test Summary (OFFUTT NG system)

System Serial Number: 0083B

		Measured							Calculated			
Time	FAT Test Step	Net AC	AC BoP	Battery (viewer)	Gross Stack (viewer)	DC BoP	Fuel-Flow (Viewer)	Thermal (viewer)	Thermal corrected	Est Net AC	Elec Eff.	CHP Eff.
		Watts	Watts	Watts	Watts	Watts	L/min	Watts	Watts	Watts		
11:15 AM	4	1619	340	-200	2800	430	17	4500	4500	1819	19.3%	
12:56 PM	6	3408	480	0	4800	560	28.6	6000	6000	3408	21.5%	

* Positive discharging

Methane LHV 553.95 Watts per liter per minute

Cp Cool (actual) 4.18 kJ / kg Water
Cp Cool (viewer) 4.18 kJ / kg Water

Appendix C

Availability, Energy Consumption and Production Summary

Format for PEM Fuel Cell Performance Data

System Number:	0083B	Commission Date:	11/20/2004		Site Location(City,State):	
Site Name:	Offutt AFB	Fuel Cell Type:	PEM			
Fuel Type:	Natural Gas	Maintenance Contractor:	OPPD			
Low Heating Value:	32.75 kJ/L	Local Residential Fuel Cost per Therm:		$/Therm	Local Base Fuel Cost per Therm:	
Capacity kW	4	Local Residential Electricity Cost per kWhr:		$/kWhr	Local Base Electricity Cost per kWhr:	

Month	Run Time (Hours)	Time in Period (Hours)	Availability (%)	Energy Produced (kWe-hrs AC)	Output Setting (kW)	Average Output (kW)	Capacity Factor (%)	Fuel Usage, LHV (BTUs)	Fuel Usage (SCF)	Electrical Efficiency (%)	Thermal Heat Recovery (BTUs)
insert month	*insert operating hours*	*insert hours in month*	**1*	*insert produced energy*	*insert output setting*	**2*	**3*	*insert fuel consumption*	*insert fuel consumption*	**4*	*insert heat recovery*
Dec-04	911	991	92%	542.8	1	0.60	13.69%	8.09E+06	9205.6	22.89%	
Jan-05	610	744	82%	2372	4	3.89	79.70%	3.33E+07	37925	24.28%	
Feb-05	192	192	100%	406	2	2.11	52.86%	6.02E+06	6851	23.01%	
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Running Totals

	Total Run Time	Total Hours in Period	Total Availability (*8)	Total Energy Produced	Average Output Setting	Total Average Output (*9)	Total Capacity Factor (*10)	Total Fuel Usage	Total Fuel Usage	Average Electrical Efficiency (*11)	Total Thermal Heat Recovery
	1713	1927	89%	3320.8	2.18	1.94	43.08%	4.75E+07	53981.6	23.88%	0

Format for PEM Fuel Cell Performance Data

System Number:	**0083C**	**Commission Date:**	**6/1/2005**	**Site Location(City,State):**
Site Name:	**Offutt AFB**	**Fuel Cell Type:**	**PEM**	
Fuel Type:	**Propane**	**Maintenance Contractor:**	**OPPD**	
Low Heating Value:	**83.4 kJ/L**	**Local Residential Fuel Cost per Therm:**	**$/Therm**	**Local Base Fuel Cost per Therm:**
Capacity kW	**4**	**Local Residential Electricity Cost per kWhr:**	**$/kWhr**	**Local Base Electricity Cost per kWhr:**

Month	Run Time (Hours)	Time in Period (Hours)	Availability (%)	Energy Produced (kWe-hrs AC)	Output Setting (kW)	Average Output (kW)	Capacity Factor (%)	Fuel Usage, LHV (BTUs)	Fuel Usage (SCF)	Electrical Efficiency (%)	Thermal Heat Recovery (BTUs)
insert month	*insert operating hours*	*insert hours in month*	*1	*insert produced energy*	*insert output setting*	*2	*3	*insert fuel consumption*	*insert fuel consumption*	*4	*insert heat recovery*
June-05	400	439	91%	539.9	1.5	1.35	30.75%	1.09E+07	4851	16.97%	
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Running Totals

	Total Run Time	Total Hours in Period	Total Availability (*8)	Total Energy Produced	Average Output Setting	Total Average Output (*9)	Total Capacity Factor (*10)	Total Fuel Usage	Total Fuel Usage	Average Electrical Efficiency (*11)	Total Thermal Heat Recovery
	400	439	91%	539.9	1.5	1.35	30.75%	1.09E+07	4851	16.97%	0